

THE DPP'S

10

things

YOU NEED TO KNOW ABOUT
LOCATION WORKFLOWS

dpp™

digital production partnership

INTRODUCTION

It's hard to believe, but location working in the television industry has been file-based for over a decade. It doesn't seem so long ago that we were still labelling tapes and couriering them back from shoots. But the fact is, working with file-based rushes on location became standard practice long ago. Plenty of people in the industry have never known anything different.

You'd expect an activity that has been going on for over ten years to feel pretty mature by now. Yet of all the subjects that DPP members cite as problematic, location workflows is most consistently top of the list. Why?

The first reason is because the move to file has enabled an increase in pace. Working on location has become more intense than ever. In the past, physical media such as film and videotape put a natural brake on the speed of production. Everyone would have to wait for the rushes to be couriered or carried back to the production office or post production facility, then be digitised, and then transferred to another medium such as DVD or VHS before they could be viewed. Today rushes can be clipped up on a laptop on location and sent straight over the Internet. The speed of turnaround has been turbo-charged.

The second reason is technological complexity. There are still no standardised ways to handle file-based rushes; connectivity is rarely straightforward; and formats are continuously evolving.

And the third reason location workflows have remained challenging is that while speed may have increased, and technology remained complex, the reality of being on location has remained the same. Off-site working is inherently pressurised, logistically complex and expensive. No two locations are the same, and the unexpected seems always to occur. Sometimes it can feel as if the world has only one purpose: to stop you getting your film made.

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That's the bad news. The good news is that ten years have brought lots of experience from which everyone can gain. And that's the purpose of this guide.

The DPP brought together a range of production companies and post production facilities to discover what best practice looks like in location workflows. What are the roles, activities and technologies that give everyone the best chance of managing the pressures of location working successfully?

10 Things You Need To Know About Location Workflows provides the answers.

Owning it

The first thing you need to know about file-based working on location is that you need someone in your team whose job is to make sure it works.

Right at the start of a project, it's vital to consider how the production will design and manage an effective workflow for the specific needs of the programme, and who will lead on that planning. If the production is complex, being shot in a new format (such as Ultra High Definition) or is time sensitive, then your post production facility is likely to assign someone to be responsible for your workflow. The actual job title can vary from facility to facility, but typically Workflow Lead, Workflow Consultant or Technical Manager are used. The workflow design and processes implemented by this person will take account of the requirements of the broadcaster, studio, production company and post production facility.

These workflow requirements are then implemented in conjunction with a Digital Imaging Technician (DIT) or Data Wrangler.

The DIT

The role of the DIT has existed in the movie industry for decades. The DIT ensures that the image – whether created from a digital or film camera – represents exactly what the Director of Photography (DoP) intended. The DIT supports the DoP and the post production team, and in digital cinema this

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role also includes the management of overnight backups of the production content and the design of the end to end system of rushes management.

So what have DITs got to do with TV? The answer is that the complexity of modern media management, the size and quality of the images being captured and the sheer ambition of so much television production, means the need for a 'digital quality control' specialist is growing. It is already normal to have a DIT on television drama; and it is an increasingly common role on high-end and large-scale documentary also.

The Data Wrangler

Many people confuse DIT with Data Wrangler. It's easily done, but the two roles have very different responsibilities. The DIT will work with the post production facility to put their workflow design into action, build the rig for content backup, monitor picture quality on location and manage rushes. The Data Wrangler's role, meanwhile, is to backup and log rushes and ensure that camera cards are appropriately labelled and protected. The table below outlines the differences between the two roles:

Data Wrangler

Ensure location team understand the naming conventions and card swapping system.

Name and backup rushes from camera cards to location storage.

Digital Imaging Technician

Test and implement a backup workflow that is appropriate to the production.

Liaise with the DoP and post production on the aesthetic of the production and ensure that rushes meet the required calorimetric and look.

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Data Wrangler

Transfer rushes from location storage to transfer drives.

Format and label cards for reuse.

Fill out a rushes log of storage media, camera information and any other shot details.

Work with the production manager to send rushes back to base.

Digital Imaging Technician

Generate Dailies for review on location and elsewhere.

Complete detailed shot reports including technical and location details.

Backup media onto storage on location and transfer a copy to post production.

Manage location storage and only remove rushes once post production have confirmed receipt and acceptability of quality.

Many television productions will not require, or be able to afford, a DIT; but few can afford **not** to have a Data Wrangler. In a smaller team, the Data Wrangler may be someone who also has other responsibilities. What is crucial however is that a member of the production team is clearly understood to have responsibility for the activities listed in the Data Wrangler column above. They are the person - along with the production manager and director - who will ensure the location workflow is executed.

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Going to plan

A production schedule can be a work of art: it seeks to find an intricate balance between time pressure, cost pressure and creative ambition.

The practical reality of acquiring pictures and sound, and ensuring the safe passage of that content back to base, has always been a key component of any schedule – and has always had an intimate relationship with time and cost. With the arrival of file-based working, and new expectations about the speed and intensity of the production process – the schedule has become more complex than ever. And so has the management of the rushes.

A failure to recognise this reality early on can lead to increased costs – and a lot of stress – further down the line. But good planning can bring out the benefits of file-based working, and make that impossible schedule become possible.

Start early

Start thinking about location workflows the moment you start to put together a production budget. You need to estimate the volume of content you plan to capture, as this will determine your storage needs and transfer costs. You will also need to decide whether you will transport rushes physically or return them to base over an Internet or network connection. Both will have costs – but they also will have very different implications for how you plan your shoot (right down to the speed and cost of your Internet connection at your hotel, for example).

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If you are working with a post production facility you should involve them at this early stage. The Production Manager (PM) is probably the best person to take the lead in these discussions. If you already have a DIT or Data Wrangler assigned to the project then also involve them early on. Together the PM, post production house and DIT or Data Wrangler can determine what the budget will need to be for location kit and management of the rushes.

Make life easy

If you are working with a DIT in your team, one way to increase efficiency is to ensure that on location they are as close to the camera set up as possible. This will allow the DoP to work with a DIT to grade the image throughout the day. As soon as a shoot is stopped for whatever reason, the DIT can take the cards and start processing. If a shot is found to be wrong then it can be reshot on the day.

You should consider whether shooting test footage is possible prior to the actual production. This will allow you to work with your post production company on a graded look for the project and save time later in the process.

If you are working with a Data Wrangler, also give thought to the environment in which they will be working. Ensure they have what they need: a power supply for their equipment; a table or desk for a laptop or backup station; and the means to maintain a direct relationship with the crew.

Assume nothing

The workflow you have planned will of course vary depending on the nature of the production. But whether you are shooting a drama or a documentary it's equally important to test your assumptions about the process. For example, how long does it take to back up 30 minutes of content at UHD

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quality? What is your planned shooting ratio; how can you control it; and how long do you need to check, label, backup, transfer and recycle the camera cards?

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Testing times

Planning and testing go hand-in-hand -
and it's a relationship that cannot be overstated.

A well planned and tested location workflow not only means your shoot will work more smoothly, but also reduces the likelihood of the unexpected.

Testing actually starts at the planning stage. Indeed, the testing process should form part of your schedule. If you are hiring in kit, get it early enough to use it in your testing process.

It's important to document your approach and test plan so that it's easy to execute and report against, and gives a record for the future. Each production is different, so while you can reuse parts of your plan, changes will still be needed for future productions.

Ideally you should test the end to end workflow. You may be able to do some of this testing at base, but you should also test from location, if possible. This could form part of the recce process, which would include shooting some test footage.

Test the look

One of the major considerations for testing is to make sure the look of the recording is what the DoP and Director intended. Collaboration is needed

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between the location production team and the post production facility to ensure you can achieve the aesthetic you want.

You should consider performing a pre-grade with a post production facility, who can then provide a LUT (Lookup Table) if you are shooting in UHD. A LUT is like an Instagram filter for video, and applies a certain look to your footage. Once you have tested your shots in this way, you will have an agreed LUT which you can take away and use on set. This process also helps to establish the workflow between DoP and DIT. Once the LUT has been developed it can be loaded on location to achieve the look and feel for the recording.

Test the backup approach

The backup process needs to be walked through and the responsibilities of the DIT or Data Wrangler clearly understood. What metadata is going to be captured and where? Who is going to be logging the data and how will it be captured?

Working out your logging approach in advance is a vital way to save time and money in post. Work through the filming scenarios and data capture requirements and then model them. Can you really film, get the information into a spreadsheet and log all within a filming day? Half an hour spent challenging the plan can save you days in the edit.

If you are working in difficult environmental conditions, such as at high altitude or in extreme temperatures, you will need to test your monitoring and data storage equipment. Hard disks for example have a recommended altitude and operating temperature. Solid state storage devices are more resilient but you should be aware that extreme climates may nevertheless have an impact. Don't forget that laptop batteries also don't work well in extreme temperatures.

USE SECURITY TOOLS

And finally, test any processes you have in place for disaster recovery: it is well worth simulating data loss, to ensure you have a good process for data recovery.

Test the production process

Test the end to end workflow while in your production office. Use sample rushes, and take them through logging, ingest, and backup – checking you can actually retrieve your content. This is the time to make sure you know what metadata you want the Data Wrangler to add – such as take numbers, clothing, product placement information and so on.

There are a number of websites and apps that can help to calculate the data rate of your rushes, and how big the resulting files will be. Don't shortcut this process – whether the calculation is undertaken by the production team, the DIT, the Data Wrangler or the post production facility, it's vital to know data volumes before the production begins. No one wants to have to send someone off to buy a new hard drive while on location.

Once you have tested and proved your workflow, don't change it during production. But when you start your next production, test it again. What works for one project may not work for the next.

Get it in writing

Location working benefits from formality: you need written instructions and a full briefing for all members of the team.

Having a clearly documented and well communicated location workflow and backup strategy is vital – not least in case one of your team has to be replaced at the last minute by someone different. Think of it as an extension of the call sheet. Everyone needs a clear role with clear responsibilities – and others, such as your editor, need to understand these roles too.

Good planning can be quickly undone if one person in the team doesn't know the process. Such lack of awareness could cause that person to recycle cards at the wrong time, mislabel content or to lose information.

It's a good idea therefore to create a simple sheet that outlines some of the basics, for example:

- what happens when camera memory cards are switched?
- who takes the ejected card back to the ingest and backup area?
- who does the ingest and backup?
- what information needs to be captured in the logging process?
- how will you manage this process? Will you use specialist software or a spreadsheet?

GET IT IN WRITING

A location by location briefing should be undertaken by the person in charge of backup in conjunction with whoever has taken responsibility for designing the process - which could be the producer, production manager, Workflow Lead or Director of Photography.

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Good housekeeping

Modern shoots generate vast amounts of data.
A little organisation can prevent you from drowning.

A typical day of high-end shooting can generate between 6 and 40TBs of content. That's an enormous amount. So how do you keep track of what's been transferred where? And how do you ensure you can find everything? Here are a few tips for good management.

Metadata

Members of a production team and filming crew come and go, but the content they have generated lingers on. That's why you can't rely on people to help you find content. You need metadata.

Technical metadata is typically exported by the camera and this should be captured and retained as part of the overall metadata set. Additional data can also be captured however. Camera systems and their companion software have the ability to add such metadata, and depending on the file format you are working with, you can either embed that metadata into the file or have it available separately.

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Logging

You can't really write the logging information you need on a tiny camera card, so a process is needed to log the cards. Ideally the logging process would capture information on date, time, cast, location, and other metadata that will be useful later in the process.

There is software available to help you, or you can simply use a spreadsheet. Modern spreadsheets that are hosted online by platforms such as Google Sheets or Office 365 are backed up automatically, and can be shared with others. This cloud based way of working ensures everyone is always working with the latest version of a document – but requires an Internet connection of course.

Organisation

Rushes may come in at different times from different cameras and different locations. It is important that while all this content is being transferred and backed up, a good, clear, logical and consistent folder and file structure is being applied and maintained. This needs to be followed by everyone, without fail. Consider how to create folders and file names that provide key information but are not too long. Avoid the use of spaces – although an underscore is a good substitute.

A naming convention that uses a series or project name, episode, date and production day is a good approach.

Create a very clean and tidy physical work area for incoming and outgoing cards – clearly signed 'Full Cards' and 'Empty Cards' and well separated.

GOOD HOUSEKEEPING

Deletion

It's tempting to take lots of cards on a shoot, and to keep everything. But that's an expensive approach, and the more cards you carry, the more difficult it is to keep track of them all.

Fewer can be better. A recycling policy, by which you download content from a camera card, back it up, delete what you don't need and then reuse the card, is not only cheaper, but it forces a discipline on the team. Everyone is nervous of deletion, but it's just the first stage of editing. It saves money by putting less content into the post production process, and it makes content easier to search.

Deletion only works if the team feel confident and empowered. Decide what constitutes a 'bad take' (because sometimes good material can still be gained from a take that went wrong). Mark bad takes at the time of shooting. The DIT or Data Wrangler can then download the cards, back up the content, and delete the selected bad takes.

Proxies

Shooting in high resolution formats such as UHD doesn't necessarily mean always having to work with big files. There are now compression technologies, such as H.265, that can make UHD formats more manageable.

Compression allows you to generate proxy copies of your rushes that can then be uploaded to an Internet based platform. There are many such solutions that allow you to upload rushes, either as proxies, or at full resolution - with a proxy copy then automatically generated by the Internet tool. The rushes can then be managed within the platform for others to review, comment or carry out a proxy edit.

GOOD HOUSEKEEPING

Proxy-based workflows such as these need to be carefully designed and tested so that it becomes easy to cross-reference the original source material further down the chain. And if you are generating proxies from high frame rate, high dynamic range or wide colour gamut materials, you need to ensure the proxy copy still maintains the desired look.

Backing up

Everything comes down to what you capture on location: your rushes.
So it's worth putting careful thought into how they're best kept safe.

The storage medium for backing up rushes tends to come in three main formats - Solid State Devices (SSD), Hard Disk Drives (HDD) and data tape (LTO).

When designing your workflow you will find yourself balancing speed, cost and efficiency. The cost, capacity and transfer speed of a storage medium tend to be inversely proportional, as we'll see below.

Storage device trade offs

SSDs provide the fastest transfer speeds but have the least capacity, and are the most expensive to buy. LTO tapes on the other hand provide the highest capacity and are relatively cheap - but offer the slowest transfer speed. Hard disk drives sit in the middle - but are less reliable than SSDs or LTO.

It is worth explaining the difference between an SSD and an HDD. An SSD is a modern storage device that stores data (that is, your rushes) without using any moving parts. The data is stored in a permanent form of flash memory - similar in principle to a USB memory stick or a compact flash card. SSDs tend to have a lower capacity than LTO tapes or HDDs; but the speed at which you can store and access data from the SSD memory is much greater.

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HDDs, meanwhile, have a magnetic spinning disk that spins at several thousand revolutions per minute. In simple terms the faster the disk spins the faster the transfer times. But because the device has moving parts it is more prone to failure than an SSD. If you drop the HDD you can cause physical damage to the disk.

In the case of both SSDs and HDDs, other factors will also influence data transfer rates, such as the type and quality of the memory modules used on the disks, the performance of the interface with the computer, and even the connecting cable.

Linear Tape Open (LTO) is a robust, cost effective tool for storing large volumes of data, but is not ideal for use on location. Older generations are slow; and while newer generations are faster, they remain noisy and can be sensitive to the conditions they are in.

One approach to reducing the overall cost of storage is to consider a tiering system, utilising fast SSD storage on location but then backing content up to lower cost LTO in your production office or elsewhere.

Below is a table showing typical transfer speeds of different storage devices:

Device	Data Transfer Speed	Capacity
LTO-6	Up to 400 MB/sec compressed	6.25 TB with standard compression (2.5:1)
LTO-7	Up to 750 MB/sec compressed	15 TB with standard compression (2.5:1)

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Device	Data Transfer Speed	Capacity
Consumer Hard Disk Drive*	228 MB/sec read and 249 MB/sec write	6 TB drive
Consumer Solid State Drive	507 MB/Sec read and 458 MB/Sec write	From 256 GB
Business Grade Hard Disk Drive	Starting from 194 MB/sec	1-10 TB
Business Grade Solid State Drive	Starting from 500 MB/sec	From 256 GB

* Taken from <http://hdd.userbenchmark.com/Explore/Fastest/13>

Resilience

Resilience is all about the ability to recover from a bad situation, such as loss or damage of the content on a drive.

It is very tempting to purchase low cost, consumer grade hard drives (particularly if they have been ruggedised). But these storage devices are simply not designed for business use. They have been designed for the home environment, and are intended for the storage of large volumes of personal media that won't be accessed on a day-to-day basis. If they're being used in a production environment they are likely to fail - and then recovering your data could be difficult.

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It doesn't cost that much more to buy business grade devices - and the benefits are huge. Business grade storage is designed to be robust.

Your business grade storage should be in a RAID setup to provide as much protection as possible. RAID means Redundant Array of Independent Disks. The principle of a RAID configuration is that within the device there is more than one drive. Those drives are either mirrored (the same data is written to two or more different drives), or the data is stored across a number of different physical disks (whether SSD or HDD). The loss of one disk drive isn't a disaster because data can be recovered from elsewhere in the RAID configuration.

There are different categories of RAID, and the higher the level, the greater the level of resilience and redundancy offered.

Business grade storage can be extremely fast at transferring data back and forth. If you are using SSD RAID and the right software, for example, you can even begin reviewing your rushes while they are being transferred.

But having business grade storage is only the beginning of ensuring you have the right level of resilience. Ideally on location you should double up the system, so that if one fails your content will be available on the other.

If you can't afford a secondary system you can still take measures to reduce the risk of loss of content. You may want to explore powering your device from an Uninterruptible Power Supply (UPS) that also acts as a surge protector. This approach will provide the storage device with a clean, constant power source and will reduce the risk of the equipment becoming faulty from a power surge. Power surges can be a particular issue when working in

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overseas locations. Importantly, in the event of a power failure, a UPS allows you some extra run-time in which to save your work and safely turn off all the devices connected to that UPS.

Efficiency

Within a workflow the overall time taken to transfer content is significant - and time, of course, is money.

The type of media and storage device used will determine transfer times. But you also need to consider the quality and matching of the cables that connect different devices.

The table below provides the theoretical maximum speed of different connection types:

Interface	Speed in bits per second (bps)
USB 2.0	480 Mbps
Firewire 800	800 Mbps
USB 3.0	5 Gbps
Thunderbolt	10 Gbps
Thunderbolt 2	20 Gbps
Thunderbolt 3	40 Gbps

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In practice the actual data transfer speeds will vary depending on the type of device and the type of data being transferred, but it is well documented that extremely fast data transfer speeds can be achieved when using SSD drives and a Thunderbolt interface. The connection interfaces between the different Thunderbolt standards have changed however, so make sure your device can work with your equipment. Only the newest devices have Thunderbolt 3 ports.

Remember not to scrimp on cables. Pairing a fast drive with a slow cable will just create a bottleneck. Check your cable is correctly rated when you buy it. This can be the difference between a very fast transfer and a painfully slow one.

How many copies?

You should keep a minimum of two copies of your content, but the recommendation is three. Check what your production insurance stipulates.

The ability to create three copies will depend on the available budget, resources and time. But crudely speaking you should always consider the cost and feasibility of reshooting against the likelihood of losing a copy of your content. That equation may help you decide how much money and effort to put into your contingencies.

Moving pictures

Getting rushes back to base can become a major headache and distraction. Know your options before you begin - they could change your whole shoot.

At some point you have to get your content back to base. And you may well need to start doing that while you are still shooting. Here are your three options:

1 **Connectivity**

Connectivity is a broad term to cover many different options for returning your rushes over the Internet or a managed network.

Think about connectivity early in your planning - it could have a big impact on how you design your trip. For example, check out the connectivity of local hotels - it might be what makes you decide which one to book. But equally you could consider negotiating access to nearby businesses, shared workspaces, universities or colleges - not to mention media production facilities.

With a bit of careful planning, it may be possible to make use of a connectivity 'drop-off'. Some post production facilities are starting to offer regional ingest points, and this allows you to make use of their connectivity.

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The DPP's **10 Things You Need To Know About Connectivity** guide goes into more detail about the various options. However, if you are using connectivity in an unfamiliar environment then make sure you still use secure connections wherever possible.

Sometimes, even if you don't have the best possible connection, you can make use of other tools that will give a boost to file transfer speeds. These are called file transfer accelerators and are also detailed in our **10 Things...** guide.

The Internet and managed networks are not the only connectivity options. Mobile and satellite based technologies are alternatives that can be considered in some circumstances. Both are commonly used by newsgathering crews.

Mobile connectivity currently means 3G or 4G - the generations of mobile technology now in common use around the world. Coverage varies from country to country and is suitable for transfers of small video files, for sending proxies or for shots for previews. 5G will be emerging in the next few years and it should allow transfer of much larger files (though 5G is still unlikely to be suitable for moving large quantities of UHD content).

Mobile connectivity can be made much more effective by the use of network bonding technologies. These tools combine a number of different sim cards (ideally from different mobile operators to increase resilience and to reduce contention) and other networks (including broadband) to provide a single high speed connection. This connection can in turn be combined with file transfer acceleration for even better performance.

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Satellite connections – while common in news – are rarely used for other forms of production apart from Outside Broadcasts. But prices are coming down, and satellite may be worth considering if it saves money in the overall workflow. Ka Band, for example, is now offered by all major satellite companies, and is a way of giving customers a broadband Internet service at a much lower cost than traditional Ku and C Band satellite. It is particularly useful in rural areas, and portable systems are available. Other similar technologies exist that make use of radio frequencies such as Microwave – though be aware of safety issues.

2 **Couriers**

Despite all of the options above, there will still be times when the most pragmatic and cost effective option is to use a courier. If you are relying on couriers, plan ahead to consider the frequency of how often you need to return rushes. Does the production schedule really require you to move them daily or can you do it weekly?

When using a courier always backup your data before handing it over. If they lose your hard drive they may only be liable to replace the drive (c. £300-500) and not the cost of a re-shoot. Using a transport drive is common practice, with rushes held on location until the transfer into the edit is successful.

3 **On site editing**

The final option is not to move your content to your edit facility – but to bring your edit facility to your location. A mobile edit suite can reduce the amount of content that needs to be transferred, especially if an insert or programme is completed on location and delivered back over a resilient satellite link.

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A note about security

If you are working on a particularly sensitive production you should consider some additional security processes whenever you are moving content.

Any logging and backup machines should be password protected and physically secured overnight to prevent theft or unauthorised access to the programme content or associated files. Internet access to this device should be limited to prevent viruses from damaging any files.

Each time your material goes through a point of transfer, it should be validated to make sure it is exactly the same as before it left. There are tools available that take a 'Checksum' of the content before you send it, which can then be compared with a Checksum after it has been received. If the content has been changed, even by a small amount, then the Checksum will be different. It's good practice to take Checksums at regular intervals during the workflow to ensure the integrity of your content.

More information on keeping content secure is available in the DPP's **10 Things You Need To Know About Cyber Security**.

..and a note about speed.

Whatever your choice about how to transport content to base, do always consider just how important it is to do so quickly. The cost may outweigh the benefit. For example, new technology is being developed by camera manufacturers to enable live streaming of proxies back to editors. It's an exciting development; but do the needs of your production really justify it?



Ultra high demands

Shooting in UHD is just like any other kind of location working – only more so!

The move to Ultra High Definition (UHD) is bringing its own challenges to location working. In part this is simply because of the size of the files. But UHD carries some other associated features – high frame rate (HFR), high dynamic range (HDR) and wide colour gamut (WCG) – and these features will also have their impacts.

The DPP's **10 Things You Need To Know About UHD** explains file size and defines HFR, HDR and WCG. But when working on location there are a few things you particularly need to consider.

HFR means shooting at up to 150 frames per second. Operating with such high frame rates impacts your operational workflow because the files being recorded are so large. But it also requires editorial decisions about where HFR will enhance the image, and where it will detract.

HDR and WCG require extra planning to make sure the colour space of your shot material is correct. As mentioned previously, one of the tools used to get the look right is Lookup Tables, or LUTs. A LUT essentially applies a predefined look to the video. If that look hasn't been discussed in advance

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then editing the raw files may make it look flat. Traditionally LUTs are used for feature films, but they are now becoming more common for television productions also.

With these developments you will require higher quality monitoring on location. This is particularly true when you have to achieve a desired aesthetic for the programme. The bandwidth needed to constantly send back rushes to the edit for review, rather than monitoring on location, can be costly in both time and money.

As UHD files can be at least four times larger in data rate than HD, the shooting time on camera cards is greatly reduced. This means you need a rigorous process for recycling cards. Also consider the time needed to transfer data from card to backup and then backup into post production. The large file sizes of UHD mean transfers will take much longer – and will also be influenced by the transfer factors discussed in Section 6, above.

You should consider whether the laptops or other machines you will be using on location are powerful enough to play back UHD files. Uncompressed, or very high frame rate, UHD content is particularly demanding on processors and graphics cards, and there are very few machines available that come with sufficient capability out of the box.

In other words, it's important that as you upgrade your cameras to UHD, you mirror this increase in the capability and capacity of other location equipment.

More information can be found in the DPP's **UHD Production Workflows Guide**.

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Getting your head into the cloud

Cloud storage can become a single hub for all of your content, and it changes the way you think about your workflows.

We tend to refer to returning content from location to 'base'. Base is usually the production office, or perhaps a post production facility. But it's becoming increasingly appropriate to consider another kind of base for your content: the cloud.

Good quality connectivity is a requirement to make effective use of cloud storage, but if you can achieve this on location through one of the means discussed in Section 7, then you'll get some benefits.

Benefits

Many cloud based platforms allow you to upload your content in stages, using specialist tools. These tools enable you to pause the upload - or, if you're leaving content to upload overnight, to automatically reconnect if the connectivity has momentarily dropped.

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You will only need to upload your content once, and thereafter the file can reside in the cloud. You don't have to worry about making extra copies as most cloud platforms (Amazon, Google Drive, Dropbox, Box and many others) offer in-built resilience and redundancy. In other words, they will make other copies and manage them.

A further benefit for production companies in using cloud storage is that they don't have to pay to maintain video storage in the office. In-house storage isn't just about the hardware of course; it's also about office space, maintenance, power and cooling, and so on. All of these hidden costs add up, so it's worth comparing the total cost of storing and managing data in your production office against using a professional grade cloud solution.

Security

Cloud storage such as Google Drive, Dropbox, iCloud or Box is known as 'public cloud'. This kind of storage gives some people security concerns, as their data will be stored with data that belongs to other people. And when their data is moved it is moved over the public Internet.

As an alternative you can make use of private cloud services. Such services provide dedicated, secure connectivity between your and the cloud provider, and you can also ask private cloud providers to hold data in physically separate storage that has been allocated just for your use. This will of course be more expensive than a public cloud solution, but it may give you the level of protection that your contracts demand.

Cloud production tools

Once your content is in the cloud you can benefit from other value-added tools and services that can interface with cloud storage. Such tools and

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services include remote reviewing tools, cloud based editing, transcoding, translation, transcription and much more. The range of cloud-based production tools is growing all the time. It also opens up an opportunity for global collaboration: your production partners can be working on your project remotely from any country.

Location working begins at home

Thinking hard about location working may just cause you to reconsider your production office too.

There are four things we can be certain will always remain true in content making. The first is that picture quality - and therefore data rates - will only go up. The second is that everything will get faster. The third is that the need to move content will only increase. And the fourth is that production teams will always be experts on luggage: they'll be forever on the road.

If you put these realities together there's a strong argument for rethinking the operating model of a production company, and its physical location.

What does it mean to be well equipped for these realities? Is it worth making some changes, or some investment, now in order to be more effective and efficient in the future? Are there partnerships that could be formed with other production companies and with forward thinking suppliers, service providers and facilities that could make the day to day reality of handling precious audio-visual content on location less of a headache?

LOCATION WORKING BEGINS AT HOME

In the end the production office is becoming just a hub for creative endeavours that mostly take place somewhere else. Thinking of being on location as the norm, rather than the exception, may invite a whole new way to think about how to run a production company. The future of location working may simply become the future of working.

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Design by Vlad Cohen

<http://www.thunder-and-lightning.co.uk>

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